

WHAT IS CLAIMED IS:

- 1 1. A plasma reactor system for processing a substrate, the plasma reactor  
2 comprising:  
3 a processing chamber for containing a plasma, the plasma comprising at least  
4 one plasma product for processing the substrate;  
5 a gas inlet coupled to the processing chamber for providing gas to the  
6 processing chamber;  
7 a first power source;  
8 an induction coil, coupled to the first power source, to couple power from the  
9 first power source into the processing chamber to sustain the plasma;  
10 a plasma shaping member positioned within the processing chamber, the  
11 plasma shaping member having a recessed portion substantially above the center of  
12 the substrate and an extended portion outside the recessed portion; and  
13 a support for the substrate positioned such that the substrate is exposed to the  
14 at least one plasma product during processing.
- 1 2. The reactor system of claim 1, wherein the material comprising the plasma  
2 shaping member is selected from the group consisting of quartz, silicon carbide,  
3 ceramic, and metal.
- 1 3. The reactor system of claim 1, wherein the electrical potential of the plasma  
2 shaping member is floating relative to ground during processing of the substrate.
- 1 4. The reactor system of claim 1, wherein the plasma shaping member is  
2 configured such that the recessed portion and the extended portion face the  
3 substrate.
- 1 5. The reactor system of claim 1, wherein the outside diameter of the plasma  
2 shaping member ranges from 60 to 90 percent of the diameter of the substrate.
- 1 6. The reactor system of claim 1, wherein a Z dimension of the plasma shaping  
2 member is greater than from about 10 to 15 percent of the outside dimension of the

3 plasma shaping member, and less than from about 25 to 30 percent of the outside  
4 dimension of the plasma shaping member.

1 7. The reactor system of claim 1, wherein an X dimension and a Y dimension  
2 of the plasma shaping member are each between 0.3 and 0.5 inches.

1 8. The reactor system of claim 1, wherein the sum of an X dimension and a Y  
2 dimension of the plasma shaping member are each as great as at least 10 percent of  
3 the height of the processing chamber.

1 9. The reactor system of claim 1, wherein the plasma uniformity is better than  
2 about  $\pm 15$  percent.

1 10. The reactor system of claim 1 further comprising a top wall of the processing  
2 chamber, and wherein the plasma shaping member is positioned adjacent to the top  
3 wall of the processing chamber.

1 11. The reactor system of claim 1, further comprising a split Faraday shield.

1 12. The reactor system of claim 1, further comprising a charged particle filter.

1 13. The reactor system of claim 1, wherein the plasma shaping member is  
2 configured such that high temperature electrons are produced adjacent to the  
3 induction coil and are substantially blocked from diffusing toward the center of the  
4 processing chamber.

1 14. The reactor system of claim 1, wherein the plasma shaping member provides  
2 a surface on which positive ions from the plasma and negatively charged species  
3 from the plasma may recombine.

1 15. The reactor system of claim 1, wherein the uniformity of the ion flux to the  
2 substrate is better than  $\pm 15$  percent.

1 16. The reactor system of claim 1, wherein the maximum potential surface over  
2 the substrate is substantially flat.

1 17. A method of processing a substrate in a reactor system, the method  
2 comprising the steps of:  
3 providing a processing chamber;  
4 coupling power into the processing chamber to produce a plasma from which  
5 at least one product is used for processing the substrate;  
6 providing a plasma shaping member within the processing chamber;  
7 exposing the substrate to the at least one plasma product for processing.

1 18. The method of claim 17, further comprising the step of producing a plasma  
2 with an ion current density uniformity less than plus or minus 10 percent over the  
3 majority of the substrate for a processing chamber diameter less than 1.3 times the  
4 size of the substrate.

1 19. The method of claim 17, further comprising the step of producing a  
2 substantially flat maximum potential surface over the substrate.

1 20. The method of claim 17, further comprising the step of recombining positive  
2 ions and negatively charged species on a surface of the plasma shaping member.

1 21. The method of claim 17, further comprising the step of preventing high  
2 temperature electrons produced adjacent to the induction coil from diffusing toward  
3 the center of the processing chamber.